Claims

1. A polymer composition essentially formed by a polymer based on titanium oxide, which may be represented by the formula $TiO_x(OH)_y(H_2O)_z$ in which x+y+z = 3, in the form of a gel or in the form of a sol, characterized in that:

- the polymer has a structure of one-dimensional (1D) character and it consists of fibers wound concentrically with a periodicity, deduced from the space in between the fibers, of between 3.5 Å and 4 Å;
- each fiber is made up of TiO_6 octahedra;
- each TiO_6 octahedron shares two opposed edges with two adjacent octahedra (2 × 2.92 Å) in order to form infinite chains that grow along the axis of a fiber; and
- two adjacent chains form double strands by the commoning of edges (2 × 3.27 Å).

2. The polymer composition as claimed in claim 1, characterized in that it is translucent and in that it contains the titanium of the polymer in oxidized form Ti^{4+}.

3. The polymer composition as claimed in claim 1, characterized in that it has a violet, blue or green coloration and at least part of the titanium of the polymer is in Ti^{3+} form.

4. A method of preparing a composition as claimed in claim 2, characterized in that it consists in:

- preparing a $TiOCl_2$ solution in dimethylformamide (DMF) by introducing $TiOCl_2$ dissolved in a concentrated aqueous HCl solution into the DMF, in proportions such that the concentration (C_{Ti}) of Ti atoms is less than 2M,
- heating the solution thus obtained to a temperature between room temperature and 90°C; and
- holding the solution at this temperature for a certain time.

5. A method of preparing a composition as claimed in claim 3, characterized in that it consists in:

- preparing a $TiOCl_2$ solution in dimethylformamide (DMF), by introducing $TiOCl_2$ dissolved in a concentrated aqueous HCl solution into the DMF, in proportions such that the concentration (C_{Ti}) of Ti atoms is less than 2M;

- heating the solution thus obtained to a temperature between room temperature and 90°C;
- holding the solution at this temperature for a certain time; and
- subjecting the composition obtained to UV irradiation in an inert atmosphere.

6. A method of preparing a composition as claimed in claim 3, characterized in that it consists in reducing $TiOCl_2$ in concentrated hydrochloric acid, using a species that is oxidizable at a potential of less than -0.05 V with respect to a standard hydrogen electrode.

7. The method as claimed in claim 6, characterized in that the oxidizable species is chosen from metals in oxidation state zero, such as Ni, Fe, Al, Cr, Zr, Ti, Nb, Cs, Rb, Na, K, Li, La and Ce, ionic compounds, in which the cation is chosen from V^{2+}, Ti^{2+} and Cr^{2+}, and ionic compounds in which the anion is chosen from $S_2O_3^{2-}$, H^-, and S_2^{2-}.

8. The method as claimed in claim 7, characterized in that the metal is zinc.

9. The method as claimed in claim 6, characterized in that it furthermore includes a UV irradiation step in an inert atmosphere.

10. The method as claimed in claim 6, characterized in that it consists in preparing a $TiOCl_2$ solution in dimethylformamide (DMF) starting with a $TiOCl_2$ solution in concentrated HCl, the concentration (C_{Ti}) of Ti atoms of the solution being less than 2M, in adding the oxidizable species, in heating the solution to a temperature between room temperature and 90°C and in holding the solution at this temperature.

11. The method as claimed in claim 6, characterized in that it consists in introducing the oxidizable species into a $TiOCl_2$ solution in concentrated hydrochloric acid, in which C_{Ti} is less than 2M, and in maintaining the reaction mixture at a temperature between room temperature and 90°C.

12. The method as claimed in either of claims 4 and 6, characterized in that C_{Ti} is less than 1M in order to obtain a composition in sol form.

13. The method as claimed in either of claims 4 and 6, characterized in that C_{Ti} is greater than 1M in order to obtain a composition in gel form.

14. A photovoltaic cell comprising a photoanode and a photocathode in an electrolyte, characterized in that the photoanode comprises a conductive glass plate coated with a layer of a composition as claimed in claim 1 in gel form, containing the titanium of the polymer in Ti^{3+} form and the photocathode is a conductive glass plate coated with a layer of composition as claimed in claim 1 in gel form containing the titanium in Ti^{4+} form.

15. Solar protection glazing, characterized in that it comprises a glass plate covered with a layer of composition according to the invention in the form of a gel.